

CLAIMS

1. A shoe sole with reinforcing structure, comprising: an outer sole; a midsole attached to a top surface of the outer sole; and a reinforcing member for reinforcing a part of the midsole, wherein

the midsole has a middle foot part,

the midsole is formed of resin foam and has a first arch at a bottom portion of the middle foot part,

the first arch has a bottom surface,

the outer sole is substantially not attached to the first arch of the midsole,

the reinforcing member has a second arch, a fore end part located in front of the second arch and a rear end part located in the rear of the second arch,

the second arch has a top surface and a bottom surface,

the fore end part of the reinforcing member is bonded to at least either the midsole or the outer sole, in front of the first arch,

the rear end part of the reinforcing member is bonded to at least either the midsole or the outer sole, in the rear of the first arch,

Young's modulus of the reinforcing member is set to be greater than that of the first arch of the midsole,

a member having a greater Young's modulus than the first arch is substantially not affixed to the bottom surface of the first arch,

the reinforcing member is arranged so that the top surface of the second arch and the bottom surface of the first arch are opposite to each other, and

at least a part of the bottom surface of the first arch is not in contact with at least a part of the top surface of the second arch in vertically spaced relationship to each other,

whereby non-contact areas of the first arch and the second arch are defined and the non-contact areas can be deformed independently from each other when impact load of landing is applied.

2. A shoe sole with reinforcing structure, comprising: an outer sole having a ground contact surface and a top surface opposite to the ground contact surface; a midsole having a top surface and a bottom surface, the bottom surface being attached to the top surface of the outer sole and covering the top surface of the outer sole; and a reinforcing member for reinforcing a part of the midsole, wherein

the midsole has a first arch covered with a middle foot part of a foot,

the first arch is formed of resin foam and has a bottom surface,

the reinforcing member has a second arch, a fore end part located in front of the second arch and a rear end part located in the rear of the second arch,

the second arch has a top surface and a bottom surface,

the second arch is located so as to be covered with the first arch,

the fore end part of the reinforcing member is bonded to at least either the midsole or the outer sole in front of the first arch,

the rear end part of the reinforcing member is bonded to at

least either the midsole or the outer sole in the rear of the first arch,

the first arch and the second arch are substantially not attached to the top surface of the outer sole and do not have ground contact when the ground contact surface of the outer sole is grounded,

Young's modulus of the second arch is set to be greater than that of the first arch,

a member having a greater Young's modulus than the first arch of the midsole is substantially not affixed to the bottom surface of the first arch,

the reinforcing member is arranged so that the top surface of the second arch and the bottom surface of the first arch are opposite to each other, and

at least a part of the bottom surface of the first arch is not in contact with a part of the top surface of the second arch in vertically spaced relationship to each other,

whereby non-contact areas of the first arch and the second arch are defined and the non-contact areas can be deformed independently from each other when impact load of landing is applied.

3. A shoe sole according to Claim 2, wherein

when impact load of landing is applied, downward displacement of the non-contact area of the bottom surface of the first arch is set to be larger than that of the non-contact area of the top surface of the second arch.

4. A shoe sole according to Claim 2, wherein
the reinforcing member has two side portions and the two
side portions are bonded to the midsole.
5. A shoe sole according to Claim 2, wherein
the bottom surface of the first arch has a first curved surface
which forms a concave surface and the top surface of the second
arch has a second curved surface which is convex upwards.
6. A shoe sole according to Claim 2, wherein
the bottom surface of the first arch and the top surface of the
second arch define a domain, and
the domain is formed to be hollow.
7. A shoe sole according to Claim 2, wherein
the bottom surface of the first arch and the top surface of the
second arch define a domain, and
the domain is filled with a filler which has a smaller Young's
modulus than the midsole and which is capable of varying its
volume.
8. A shoe sole according to Claim 6, wherein
entire of a peripheral edge of the reinforcing member is
bonded to the midsole, thereby to seal the domain.
9. A shoe sole according to Claim 7, wherein
entire of a peripheral edge of the reinforcing member is
bonded to the midsole, thereby to seal the domain.

10. A shoe sole according to Claim 6, wherein
an opening passing through the second arch vertically is
formed.

11. A shoe sole according to Claim 2, wherein
the first arch is formed of foam of ethylene-vinyl acetate
copolymer, and

the reinforcing member is formed of non-foam of
polyurethane, or foam or non-foam of ethylene-vinyl acetate
copolymer.

12. A shoe sole according to Claim 2, wherein
the reinforcing member further comprises medial and lateral
side portions on the medial side and lateral side of a foot of the
second arch, and

the medial and lateral side portions of the reinforcing
member are bonded to the midsole.

13. A shoe sole according to Claim 2, wherein
the outer sole is separated into a fore foot part and a rear
foot part at a position corresponding to an arch of the foot,

the fore foot part and the rear foot part of the outer sole each
have a top surface and a bottom surface,

the fore end part of the reinforcing member is sandwiched in
between the top surface of the fore foot part of the outer sole and
the bottom surface of the midsole, and

the rear end part of the reinforcing member is sandwiched in

between the top surface of the rear foot part of the outer sole and the bottom surface of the midsole.

14. A shoe sole according to Claim 2, wherein
the midsole includes an upper midsole body and a lower midsole body,

the upper and lower midsole bodies are formed of an ethylene-vinyl acetate copolymer, and

the reinforcing member is bonded to the upper and lower midsole bodies with both of the fore end part and the rear end part of the reinforcing member sandwiched in between the upper midsole body and the lower midsole body.

15. A shoe sole according to Claim 2, wherein
the reinforcing member constitutes a first reinforcing member,

a second reinforcing member other than the first reinforcing member is provided, and

the second reinforcing member is arranged below the first reinforcing member.

16. A shoe sole according to Claim 2, wherein
the center line of the first arch in the longitudinal direction and the center line of the second arch in the longitudinal direction are arranged at least just under a navicular bone, a cuboid bone or the cuneiform bone of the foot.

17. A shoe sole according to Claim 2, wherein

the first arch has a top surface,

the top surface of the first arch has a third curved surface which is convex upwards so as to be approximately along with the arch of the foot.

18. A shoe sole according to Claim 2, wherein

the bottom surface of the second arch has a fourth curved surface which forms a concave surface recessed upwards.

19. A shoe sole comprising:

a midsole having a foot bearing surface and a bottom surface, the bottom surface including a middle foot arch portion and a remaining portion,

an outer sole having a ground contacting surface and a top surface, the outer sole being attached to and coextensive with the remaining portion of the bottom surface of the midsole,

a first arch formed in the bottom surface of the midsole at the middle foot arch portion, a bottom surface of the first arch being concave downward, and

a reinforcing member for the middle foot arch portion, the reinforcing member comprising:

a second reinforcing arch, the first and second arches juxtaposed upon each other, the top surface of the second arch being convex upwards toward the bottom surface of the first arch,

wherein portions of such top and bottom surfaces are in spaced apart relationship to each other and such portions deform independently from each other upon application of an impact load

to the sole,

wherein the second reinforcing arch has a greater Young's modulus than the first arch and a member having a greater Young's modulus than the first arch is substantially not affixed to the bottom surface of the first arch.